



The Solutions Network

Rochester, New York

## Opportunities to produce electricity using vertical axis wind generators

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### Topic

#### ❖ The Darrieus type Vertical Axis Wind Turbine (VAWT)

- So far, among VAWTs, only Darrieus has a well established record of successful operation in the range of a hundred kilowatts to multi-megawatts
- Significant wind power production requires a wind turbine that sweeps a large area

August 8-11, 2004

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## Technology Background

- ❖ Georges-Jean-Marie Darrieus's invention:

TURBINE HAVING ITS ROTATING SHAFT TRANSVERSE TO THE FLOW OF THE CURRENT (*UNITED STATES PATENT 1,835,018 awarded In late 20's*)

- ❖ In the 60's, the National Research Council (NRC) of Canada added the troposkien shape. Since then, NRC has continuously supported the development of this technology

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## Technology Background

- ❖ Since the early 70's, the U.S. Government Sandia National Laboratories (SNL) has played a key role by developing mathematical models as well as building and testing a wide variety of VAWTs and blade designs.



17 m Sandia VAWT built in 1975

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## Technology Background

- ❖ Commercial operation of FloWind wind farms installed in California in the 70's, and elsewhere since, continues successfully to this day



100 kW FloWind Wind Farm in California

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## Technology Background

- ❖ In the 80's, Hydro Québec and NRC (Canada) built and tested the 4 MW Éole designed to comply with utility standards
- ❖ Éole was the most advanced wind turbine at the time and remains so to this day
- ❖ Over its 6 years testing period, the average overall availability of Éole exceeded 94%



4 MW Éole, Cap-Chat, Québec

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## Technology Background

- ❖ Éole was the first:
  - Wind turbine designed for -40° C operation
  - All steel VAWT
  - Direct driven wind turbine
  - Fully variable speed wind turbine
  - Grid quality electricity wind turbine
  - AC/DC/AC power conversion system

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## Dermond technology

❖ The Dermond design improves VAWT technology by:

- Eliminating the guy wire system
- Mounting the wind turbine on a tower
- Lowering turbine weight



Dermond wind turbine

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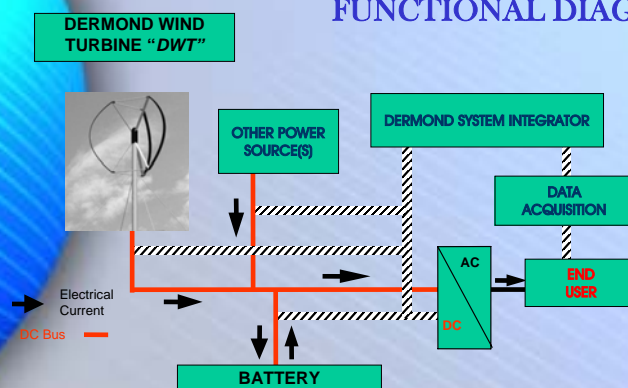
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## Dermond technology

WindStor<sup>SM</sup>

### FUNCTIONAL DIAGRAM



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## Why Darrieus VAWT ?

- ❖ The Darrieus VAWT has two clear and decisive advantages over HAWT technology:
  - Mechanical simplicity
  - Not affected by changes in wind direction

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## Mechanical simplicity

- ❖ Compared with HAWT, Darrieus VAWT has no:
  - Yaw mechanism to turn the rotor into the wind.
  - Nacelle
  - Pitch control mechanism
  - Need for a wind direction sensing element

This eliminates:

- All risks associated with the failure or malfunction of such equipment
- All costs of the equipment itself
- Associated maintenance and operation costs

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## Not affected by change in wind direction

- ❖ VAWT is better adapted than HAWT for applications such as:
  - Open spaces with frequent changes in wind direction
  - Building rooftops
- ❖ Unlike HAWT, VAWT doesn't lose energy when wind direction changes and doesn't require power to realign the turbine into the wind

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## Application where VAWT is better adapted than HAWT



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## Application where VAWT is better adapted than HAWT



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